2.5 Disposal Procedures

A 1957 letter,[11] the earliest available description of the disposal routine, indicates that NRTS-generated solid waste was picked up twice a week. The operation of the Burial Ground was then the responsibility of the Site Survey Branch, Health and Safety Division, of AEC-ID, but actual burial operations were provided by the Central Facilities maintenance contractor.[4] (See Table 1.)

Routine solid waste was defined in terms of the personnel exposure caused by handling. If the health physicist who took radiation readings outside the metal container and in the truck cab determined that handling the waste would not cause personnel to exceed their daily exposure limits, the waste was handled as routine waste.[7]

Routine solid waste was packaged and disposed as follows:

a. Waste was placed in 0.8 by 0.8 by 0.9-m cardboard boxes and sealed with masking tape.

b. Cardboard boxes were placed in metal Dempster Dumpster containers, marked and used for radioactive waste only. Such containers were provided at the areas where waste was generated.[11]

These routine waste disposals were made under the supervision of a health physicist from the AEC-ID Site Survey Branch.

Nonroutine (high-radiation-level) waste that could cause excess personnel exposure was transported in special containers and transfer vehicles. As shown in Figure 2, a long-tongue trailer, pulled behind a pickup truck, was used to haul material contained in a 0.6 by 0.6 by 0.9-m wooden box or in a 113.6-L garbage can. NRTS contractors used a coffin and a lead open-top box container to shield the high-radiation-level waste. The nonroutine disposals were controlled by the Site Survey Branch of AEC-ID and were carried out under the supervision of a health physicist.

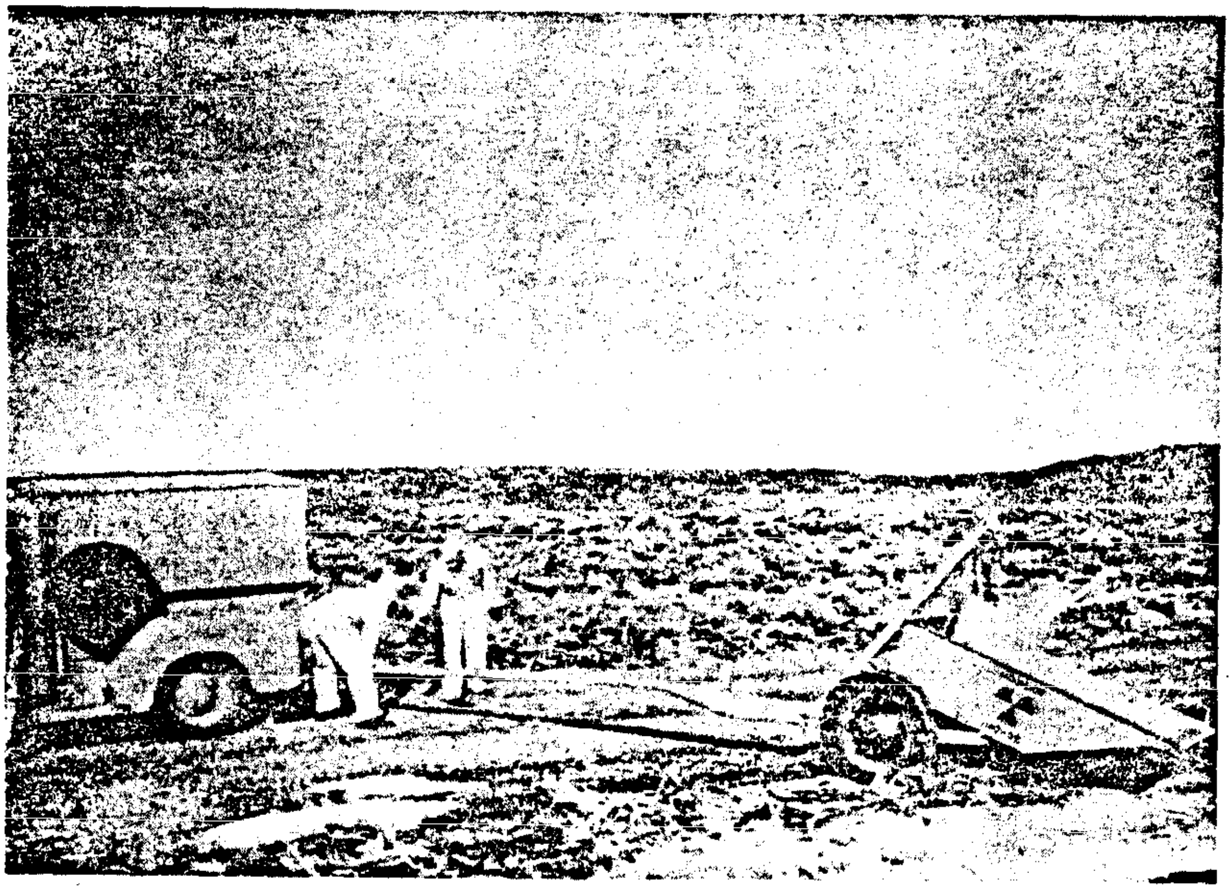


Figure 2. High-radiation-level waste disposal in 1950's.

At least up to 1957, no upper limit had been set on the level of radiation that could be handled; items of up to 12,000 R/hr were buried.[11]

Routine waste was dumped into the trenches (Figure 3) and probably not covered with earth until the end of the operating week.[5] Nonroutine waste deposited into the trenches was immediately covered with earth, but records of the earliest burials give no indication of the depth of earth cover or limits on radiation emitted.

Curie content and disposal location were recorded for the earliest disposals.[7] In those records the responsible personnel attempted to inventory each load, but completion of a form was not required as part of the disposal procedure.

In 1957, AEC-ID Manual, Chapter 0500-7, spelled out the responsibility and the organization involved in disposal of solid radioactive waste at the NRTS Burial Ground.[12,13] A 1959 supplement to the ID Manual, Chapter 0500-7, (a) made the organizations disposing of (or transporting) waste responsible for labor, equipment, and services in connection with the disposal operations, (b) required a standardized form to be filled out for each disposal, and (c) formally defined routine and nonroutine waste.[13] Organizations disposing of waste were responsible for safe packaging, personnel protective clothing, film badge and dosimeter monitoring, and equipping transport vehicles with "Radioactive Materials" signs on the front and rear. The organizations received permission to bury waste and obtained a key to the Burial Ground from the Site Survey Branch. With a health physicist present, waste was dumped in areas of the trenches clearly marked for disposal by signs on metal posts that were welded to truck wheelbases. The organization then returned the key and a completed "Waste Disposal Request and Authorization," Form ID-110, to the Site Survey Branch.

Waste was handled as nonroutine if it

a. Emitted over 500 mR/h at 0.9 m

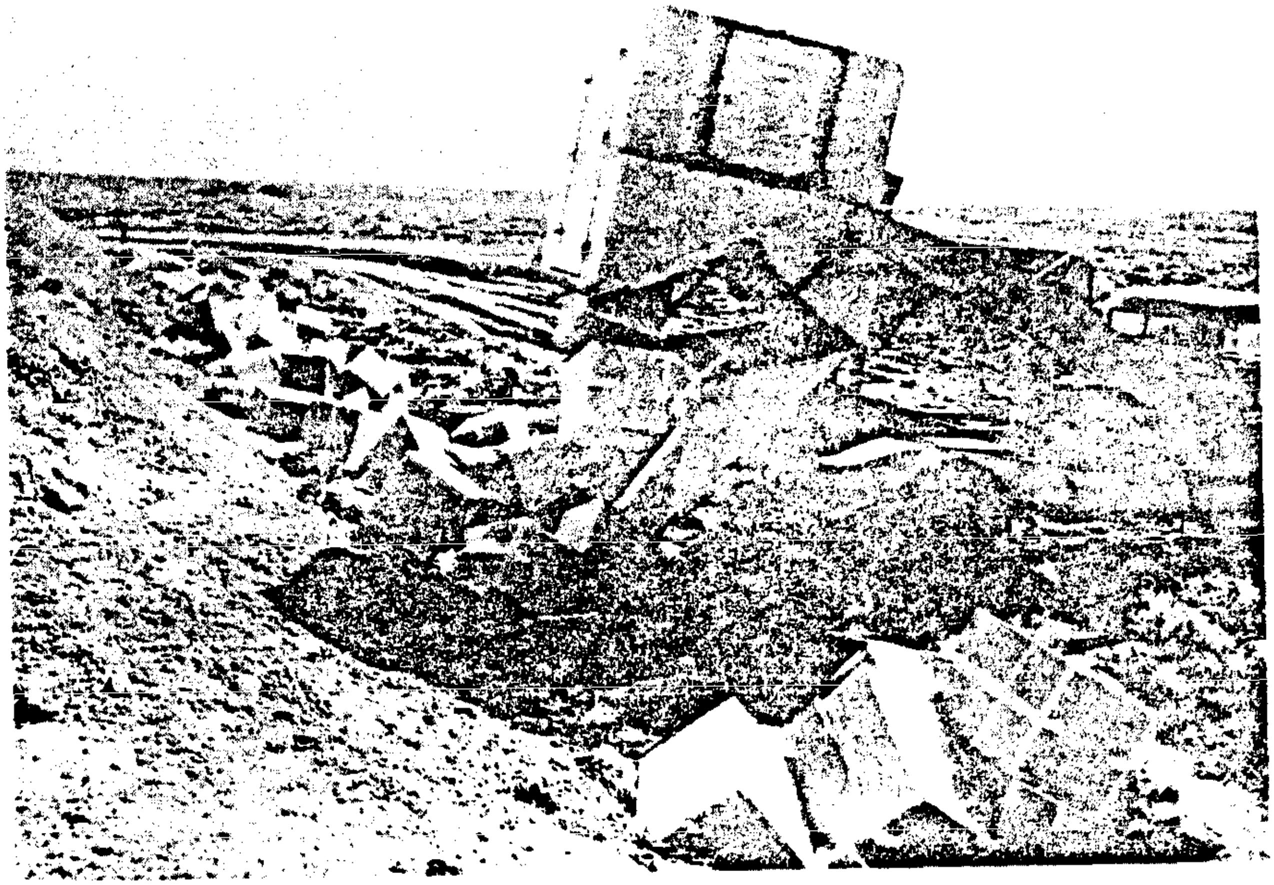


Figure 3. Dumping of boxes containing routine waste, 1950's.

b. Required special handling, special hauling, or shielded containers

c. Was source material (plutonium-238 or thorium), liquids, or slurries.

Arrangements to dispose of nonroutine material were made in advance with the Site Survey Branch; Form ID-110 was also submitted in advance to the Site Survey Branch for special approval and instructions.

2.6 Disposal of Rocky Flats Waste

In 1953, AEC decided that solid radioactive waste from its Rocky Flats Fabricating Facility near Golden, Colorado, would be sent for disposal to the Burial Ground, since waste burial in the Golden area was not acceptable.[14] Trucking quotations from Rocky Flats to either NRTS or Las Vegas were identical, but contacts at NRTS had communicated that they could accept the Rocky Flats waste, and the NRTS Burial Ground was selected for disposal of the Rocky Flats Waste.[15,16]

The first shipment of Rocky Flats waste was authorized in March 1954. This shipment was to be a trial run to provide (a) handling and shipping experience and (b) cost information to compare with alternative disposal methods, such as disposal at sea or disposal at other AEC installations.[15,17] At this time, a concern was expressed for reducing waste bulk, primarily to reduce shipping and handling costs. The memorandum authorizing this shipment stated that a final solution might be the establishment of a regional burial site for the western United States.[15]

The first drums from Rocky Flats arrived on April 22, 1954. Since this trial run proved that such shipments could be handled satisfactorily,[18] the AEC authorized the shipment of Rocky Flats waste to the NRTS.

The early waste shipments from Rocky Flats were not accompanied by papers describing the physical and radionuclide content. Instead, a memorandum from Rocky Flats was written at the end of each year summarizing the total radionuclide content and volume of the waste shipped to the NRTS. All shipments, however, were subject to Interstate Commerce Commission regulations.[19]

Between April 1954 and November 1957, the transuranic (TRU) contaminated waste from Rocky Flats was interspersed with NRTS mixed-fission-product waste in Trenches 1 through 10.[9]

2.7 Burial Ground Expansion

Since the 5.2-ha Burial Ground was nearly filled by 1957, it was then expanded to its present size of 35.2 ha, encompassing most of the 40.0 ha surveyed by the USGS in 1952. The expansion also enclosed an acid pit that had been used for disposal of radioactive laboratory acids since January 1, 1954.[4,10,14]

2.8 First Pit Disposals

Excavation of pits began in 1957 to accommodate large, bulky items being shipped from Rocky Flats. The amount of waste from Rocky Flats was rapidly increasing at that time. Trenches were used for disposal of the MFP waste; but MFP waste too bulky to fit into the trenches was also placed in pits.[9] Figure 4 illustrates the pit and trench locations at the Burial Ground.

Pit 1 was opened November 1, 1957,[10] and was located in the northeast corner of the original 5.2-ha site. (Card[9] indicates that the pit was opened earlier, on September 26, 1957.) Table 3 presents the opening and closing dates of the pits and trenches at the Burial Ground.

Tractor-drawn scrapers excavated the pits until the basalt was exposed. Pit dimensions range from 15.2 to 91.4 m wide, 76.2 to 335.3 m long, and 1.5 to 4.6 m deep.[3,8]

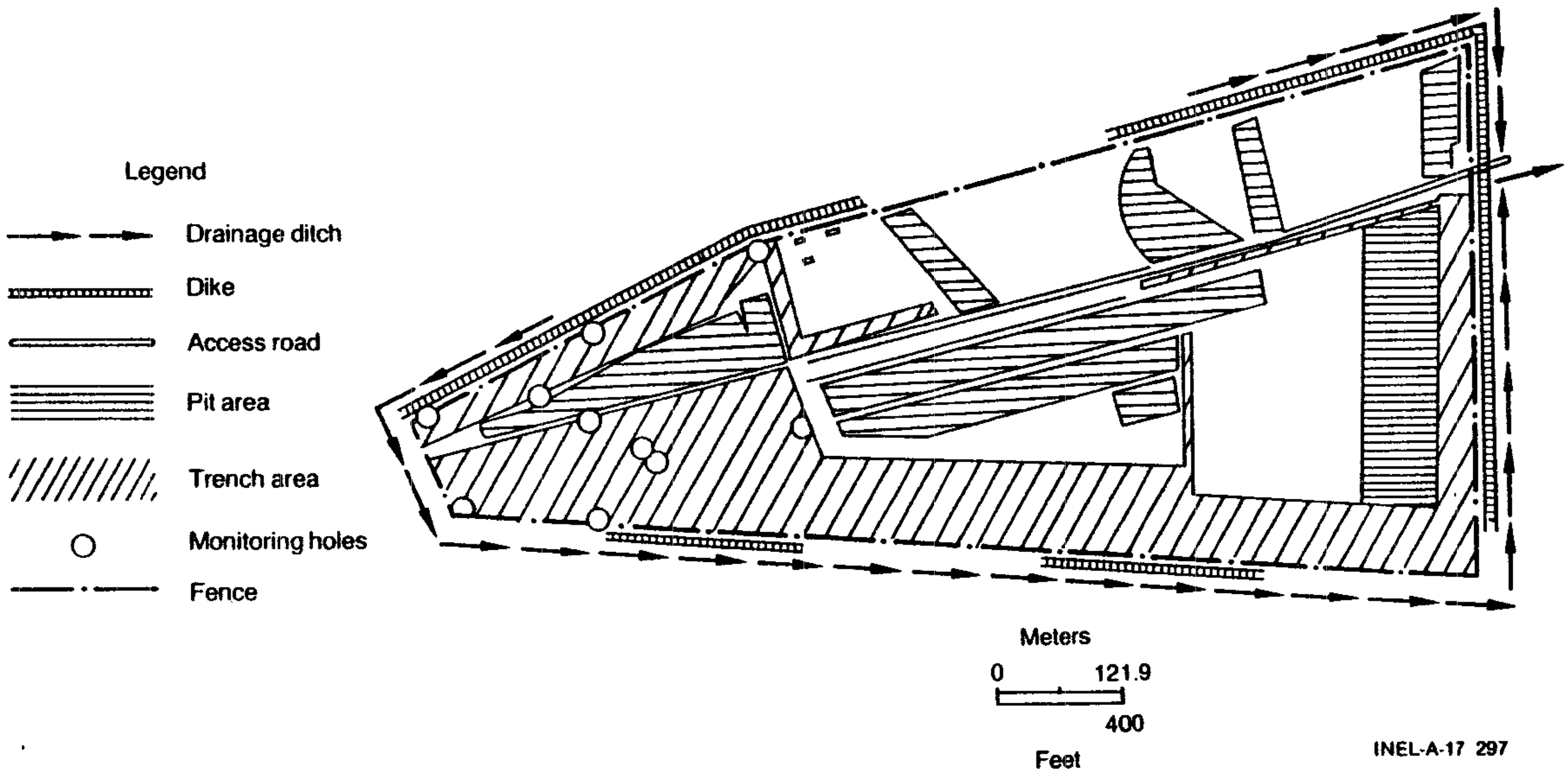


Figure 4. Plan of NRTS Burial Ground.

Rocky Flats waste destined for the pits was packaged either in 113.6-L or 208.2-L steel drums, and the bulkier items were packaged in wooden crates.[8,17] Waste arrived by railcar at the Central Facilities Area, was transferred to a flat-bed semitrailer truck, and then was taken to the Burial Ground.[5] The drums were hand-stacked in the pit (Figure 5).[17] A crane lifted the wooden crates from the semitrailer and stacked them around the edges of the pit.[6,9] The records do not list the specific location of boxes when a shipment contained both boxes and drums. The crane also could be used to lift drums one at a time into the pit. Workers manually arranged the drums and rigged and unrigged the crane. The waste in the pits was covered with earth periodically, but on no set schedule.

The metal tag markers were replaced by a system of concrete survey monuments installed at the ends of the centerline of each trench and at the corners of each pit in the late 1950s.[17,20] These monuments (Figure 6), still in use, are 1.8 m high, 40.6 by 40.6 cm at the bottom, and taper to 20.3 by 20.3 cm at the top. A metal lifting lug and a brass plate are secured to each monument. The plate is stamped with the trench or pit number, the date opened, the date closed, and a direction arrow.[14] Although considerable effort was made to clearly define the boundaries of the early trenches and pits when the metal tag system was replaced, some of them now marked by concrete monuments may not be well defined.

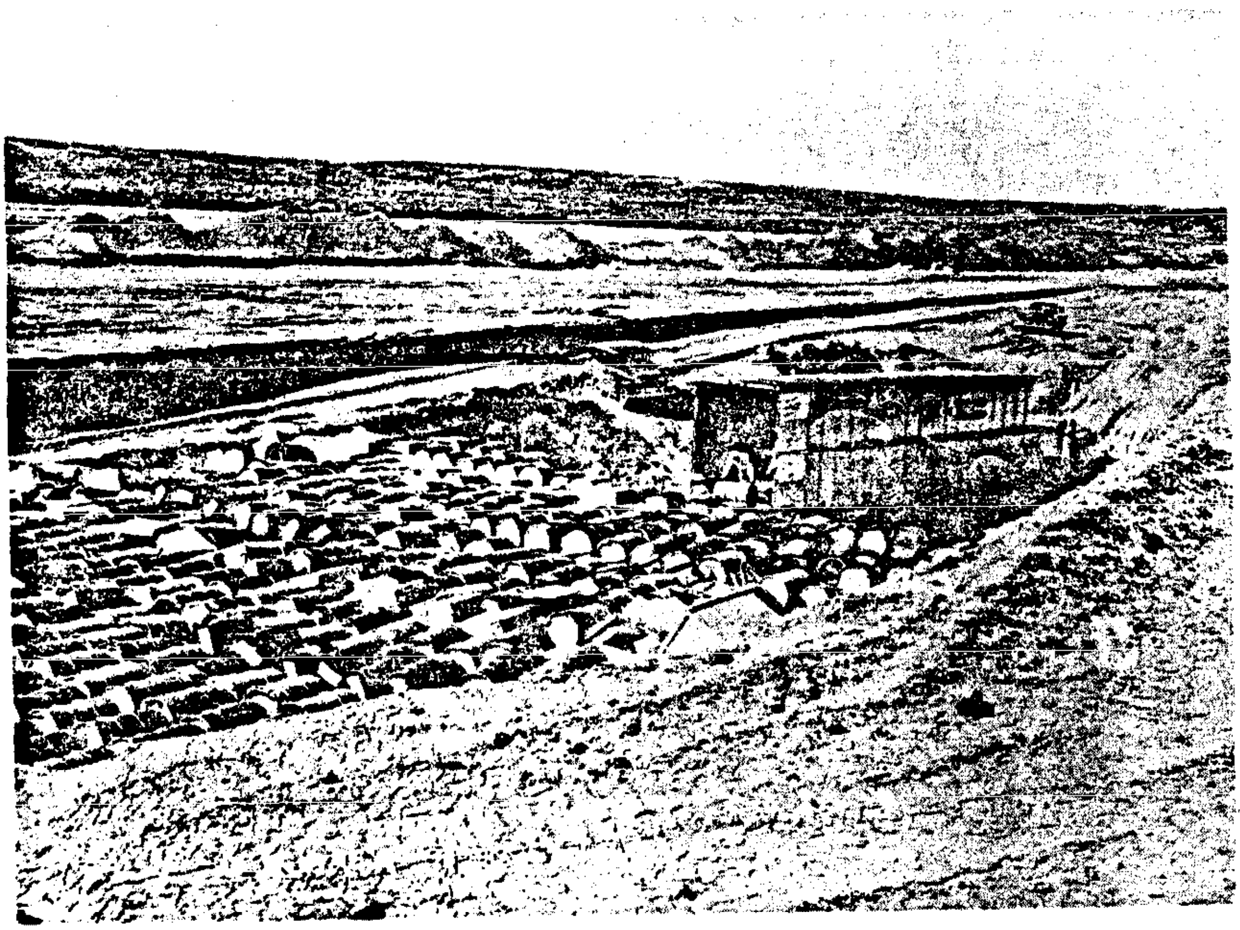
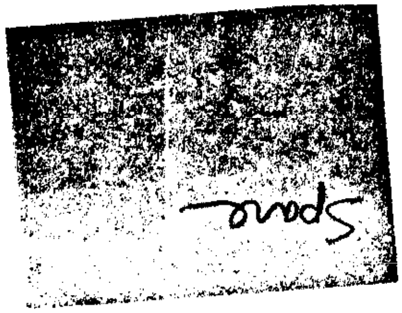


Figure 5. Hand stacking of drums, 1950's.



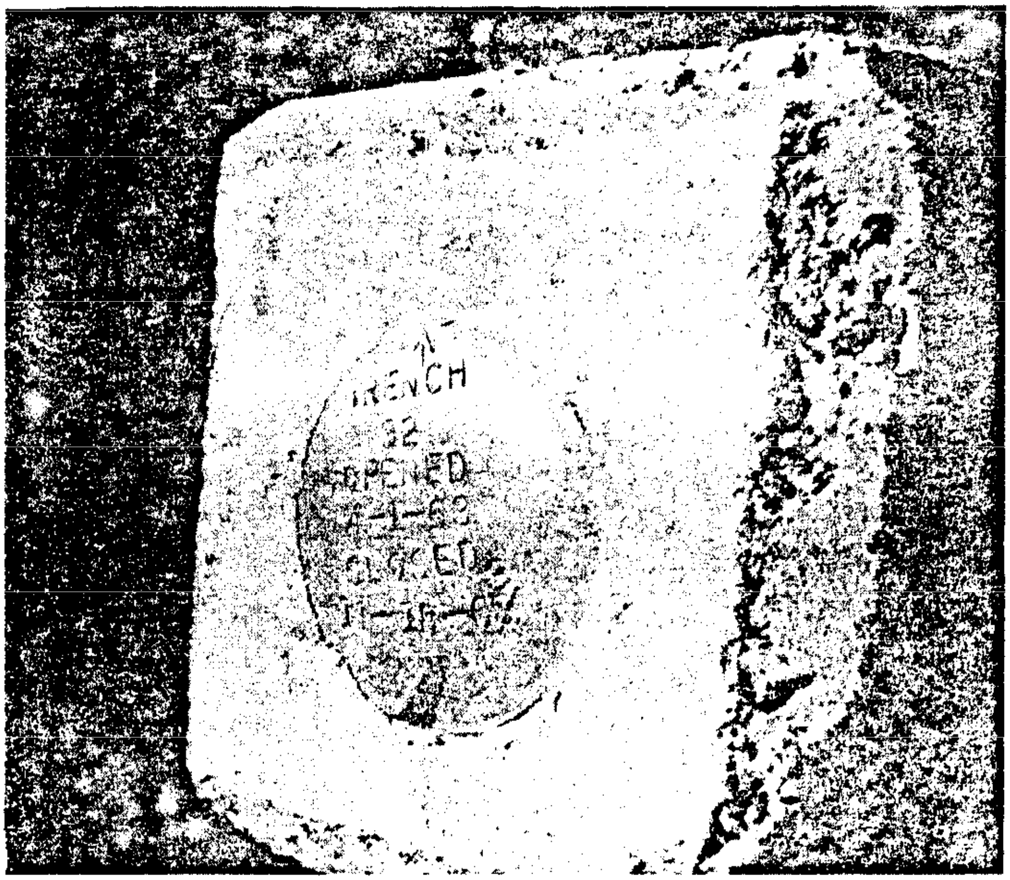


Figure 6. Concrete survey monument marking trench location.

3. INTERIM BURIAL GROUND (1960-63)

During the 1950s, the rate at which private industry (AEC licensees) generated radioactive waste was increasing. Since no commercially operated burial ground existed for this waste, most of the licensees used the services of seven firms that disposed of packaged solid waste in AEC-approved areas off the U.S. coast.[21] In late 1959, the AEC decided that land burial had definite advantages (particularly economic) over sea disposal. In January 1960, the AEC announced its intention to establish regional solid waste burial grounds that would be privately operated on state or federal lands. And, since time would be required to evaluate the geology, hydrology, and topology of proposed regional burial grounds, the AEC decided to establish an interim burial ground program.[21]

In May 1960, the AEC designated the Idaho NRTS and the Tennessee Oak Ridge National Laboratory (ORNL) as the interim burial grounds.

3.1 Interim Burial Ground Program Policies and Procedures

The information in the following discussion pertains only to offsite waste received during the Interim Burial Ground Program. Onsite waste policies during this period are discussed in later subsections. Most of the information on the Interim Burial Ground Program was taken from Reference 21.

At the request of the AEC, ORNL and NRTS coordinated their burial policies and procedures, which included the following:

a. Only solid waste was accepted.

b. Conformance to existing federal regulations was required for all shipments and packaging.

c. To apply for service, the customer filled out an order form and a waste shipment data sheet and returned them to the burial ground management; waste could not be shipped until the customer received approval.

d. The waste was accepted free on board (f.o.b.) at the burial site; the generator was responsible for all packaging and shipping.

e. Any unusual handling expense, such as for extra heavy packages or special services, was charged to the customer.

f. The customer paid the full cost of any decontamination or special handling required because of the shipment's failure to meet AEC and other applicable health and safety standards.

g. The ORNL and the NRTS also established formal procedures for dealing with improper or problem shipments.

During the Interim Burial Ground Program, the AEC established and maintained a record of all radioactive waste burials in the U.S. At first, each AEC operations office was required to submit a monthly burial summary to the AEC Headquarters, Division of Production; later this summary was required every six months.

In May 1963, the AEC issued a press release withdrawing its services at the interim burial grounds for radioactive waste shipped on or after August 12, 1963, because other suitable burial sites had been established by private industry. (Records of waste buried at the NRTS Burial Ground during this program are in EG&G Idaho, Inc., Waste Programs Division files stored with Records Management.) From then on, the AEC General Manager's approval was required for burial of any licensee waste at the NRTS. Rocky Flats waste, however, was still received, mainly because privately operated burial grounds were not allowed to receive classified waste or material from which sensitive information could be derived by sampling or observation.[22]

3.2 Transfer of Burial Ground Operation

During the Interim Burial Ground Program, operation of the NRTS Burial Ground was delegated to the NRTS operating contractor. In October 1962, the responsibility for both managing and operating the Burial Ground was [redacted] which had been acting as the AEC-ID agent in operating the Burial Ground. PPCo then assumed responsibility for health physics surveillance within the Burial Ground and handled special arrangements for disposal directly.[23]

3.2.1 Standard Practice

After the formal transfer, [redacted] to further formalize burial operations involving NRTS waste.[24] The standard practice outlined disposal operations as described below.[25]

3.2.1.1 Disposal of Routine Waste. Routine, low-radiation-level, solid waste, emitting less than 500 mR/h, was to be boxed in cardboard cartons, placed in Dempster Dumpsters, transferred to the Burial Ground, and dumped into trenches. Routine disposal was limited to a 3 by 3 by 6.1-m bulk of less than 9.07 metric tons. Trenches were to be excavated 1.5 m wide, at least 0.9 m deep on 4.9-m centers. Trenches were to be backfilled such that radiation 0.9 m from the surface was less than 1 mR/h. Partly filled trenches were barricaded at the 60 mR/h point to limit access and control radiation exposure. After each trench or pit was filled and backfilled with at least 0.9 m of dirt, the location was permanently marked with a concrete monument.

3.2.1.2 [redacted] Nonroutine waste that required handling with special equipment was limited to 45.4 metric tons in one unit. A health physicist was on duty at the Burial Ground to guide the operation, witness the disposal, and sign the disposal records.

[redacted]und.
Fissile material was closely supervised within the following guidelines.

a. All fissile material was to be identified, and the maximum amount was to be stated on the disposal form.

b. Less than 300 g of ^{235}U or 200 g of ^{239}Pu could be disposed of in units such that there were no more than 400 g of ^{235}U or 267 g of ^{239}Pu per 0.028 m^3.

c. Quantities greater than 300 g of ^{235}U or 200 g of ^{239}Pu were to be isolated from the rest of the waste material and buried only after approval by the PPCo Nuclear Safety Committee.[25]

On January 2, 1964, PPCo updated its standard practice to incorporate Forms ID-136 and ID-137 used during the Interim Burial Ground Program.[4]

3.2.2 TRU Waste Disposal

Beginning in November 1963, Rocky Flats waste was no longer stacked but was dumped in pits to reduce labor costs and minimize personnel radiation exposures[26] (see Figure 7). Random dumping continued until 1969.

3.3 Incidents at the NRTS

Two NRTS incidents during this period impacted waste management practices--an accidental criticality excursion at the Army Stationary Low Power Reactor (SL-1) in 1961 and a localized flood in 1962.

3.3.1 SL-1 Accident

An accidental criticality excursion occurred on January 3, 1961, at SL-1 located at the Army Reactor Area (now the Auxiliary Reactor Area

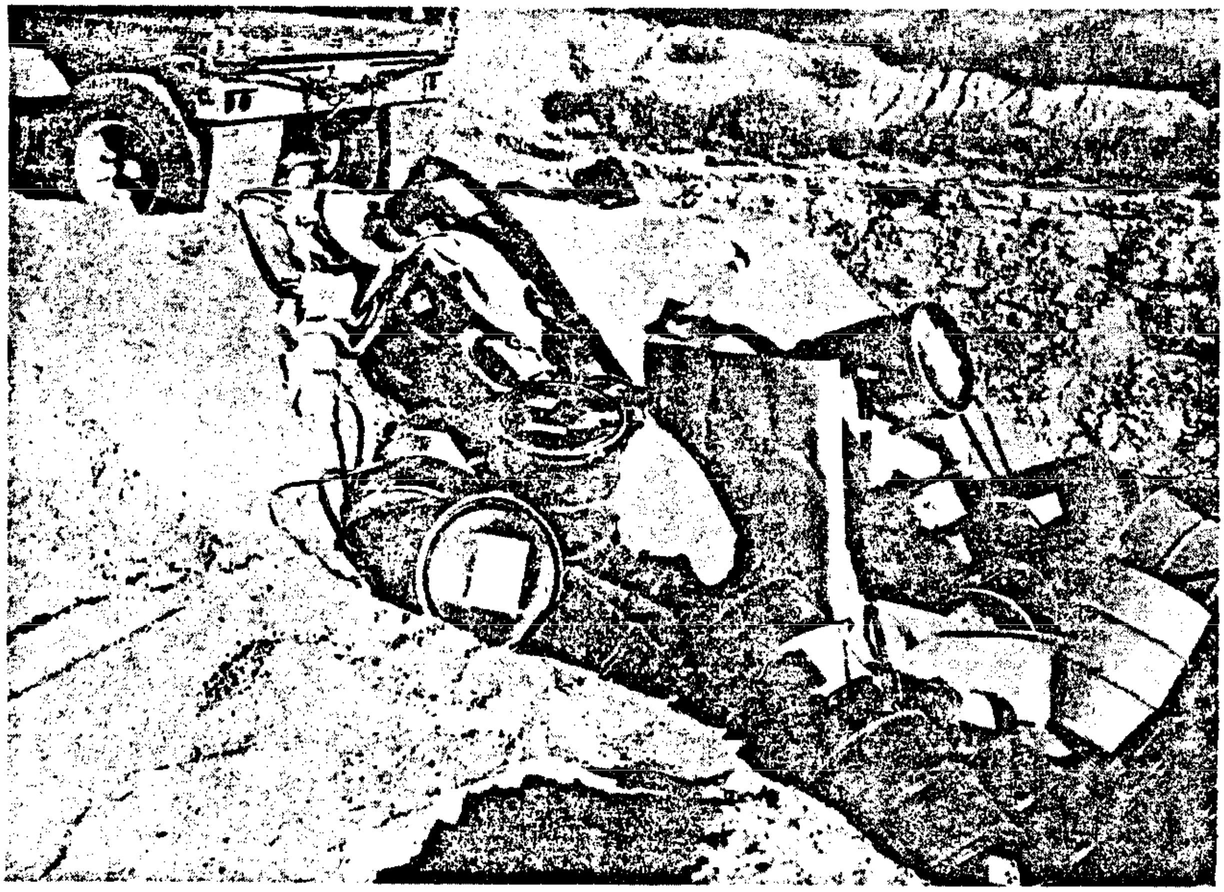


Figure 7. Dumping of drums (1963-69).

ARA-II). To accommodate the contaminated materials resulting from the accident, a separate burial ground (the SL-1 Burial Ground) was opened on May 23, 1961.[27]

Although most of the SL-1 waste was disposed in the special burial ground, [redacted] was [redacted] for that purpose. Data in the Radioactive Waste Management Information System (RWMIS) do not support the contention that Pit 1 was reopened to receive SL-1 waste. The disposal locations in RWMIS are one-dimensional, expressed as a distance from one point. Because SL-1 Pit 1 is long and narrow, like a trench, a disposal location would be expressed as a distance from one end. Burial Ground Pit 1 locations require north/south and east/west coordinates. Furthermore, the health physicist who worked at the Burial Ground during this time has stated that Pit 1 was not reopened.

The SL-1 Burial Ground was established 0.4 km from the reactor location, approximately 7.2 km north of the NRTS southern boundary and 14.5 km west of the southeastern boundary. The 1.6-ha site is fenced and contains one trench and two pits about 152.4 m long.[28] The SL-1 Burial Ground was closed July 27, 1972, and has since been surveyed semiannually.[27] The Waste Programs Division, RWMC Operations (WP-O) Branch is presently responsible for maintenance of the SL-1 Burial Ground.

3.3.2 1962 Flood

In February 1962, approximately 4.6 cm of rain fell on 20.3 cm of snow in three days. The upper foot or so of undisturbed ground was frozen, causing much more run off than normal from the area surrounding the Burial Ground. Pits 2 and 3 and Trenches 24 and 25 were open and were filled with water.[3] Figure 8 is a photograph of the 1962 flood.

The flood conditions and subsequent actions are described in detail in References 7 and 14. Some of the low-radiation waste boxes and barrels floated around in the flood water. After some boxes were broken, the radioactive contents, such as gloves and sample bottles, became distributed

Figure 8. 1962 "Chinook"-caused flood at Burial Ground.

in undisturbed areas within and adjacent to the RWMC. A radiation survey was immediately initiated. All contaminated items found outside a designated burial location were collected and redeposited in a pit or trench. All detectable surface contamination was confined to areas in and around the Burial Ground. Water samples from monitoring holes immediately adjacent to the trenches indicated no significant migration of radionuclides through the soil as a result of the flooded conditions. No general contamination spread was detected on the ground surface. After this local flooding, a diversion drainage system was constructed around the perimeter of the Burial Ground.

3.4 Environmental Monitoring

Two major improved environmental monitoring systems were initiated during the Interim Burial Ground Program. These remain part of the current environmental surveillance plan (see Section 5.4.9).

The first was subsurface water monitoring. In 1970, the USGS drilled ten monitoring holes to the basalt surface at the request of the Site Survey Branch. These holes were drilled in the western section of the Burial Ground, which was essentially filled by 1960.[29,30] The USGS monitored these holes occasionally and could also check them after flooding or other incidents that potentially affect subsurface water, e.g., the 1962 flood described previously.

The second improvement was in radiation monitoring. In 1960, 35 film badges were evenly spaced around the perimeter fence of the Burial Ground to monitor the direct radiation levels.[7]

4. WASTE BURIAL (1964-70)

The period between 1964 and 1970 was characterized by increased environmental assessments of NRTS radioactive waste disposal practices. The late 1960s saw the passage of environmental laws, culminating in the National Environmental Policy Act of 1969. [redacted] and the waste from the fire cleanup was shipped to Idaho, environmental concern focused on the NRTS.

4.1 Environmental Concern

The original USGS survey of the NRTS suggested the possibility of waste disposal operations contaminating the Snake River Plain aquifer underlying the NRTS but considered this possibility unlikely because of the arid environment. During the Interim Burial Ground Program, a similar concern had been voiced.

By the mid-to-late 1960s, several individuals and groups began to question the wisdom of disposing of TRU waste over the aquifer. In 1966, the National Academy of Sciences Committee on Geologic Aspects of Radioactive Waste Disposal questioned the concept of an arid environment protecting the aquifer from contamination. After visiting the NRTS in June and July of 1960 and again in May of 1965, the Committee noted that ultimate leakage of plutonium wastes from corroding steel drums was inevitable and expressed concern about continued waste disposal above the aquifer.[3,31]

4.1.1 Environmental Studies

Many studies by the AEC, other federal agencies, and the State of Idaho then followed. In October 1968, the Federal Water Pollution Control Administration surveyed the Burial Ground to determine whether additional controls were necessary to improve water quality as set forth by Executive Order 11288, "Prevention, Control, and Abatement of Water Pollution by Federal Activities."[32]

In 1969, after the waste from the Rocky Flats fire had been sent to the NRTS Burial Ground, Idaho Senator Frank Church requested that four federal agencies (the USGS, the Bureau of Radiological Health of the U.S. Public Health Service, the Federal Water Pollution Control Administration, and the Bureau of Sport Fisheries and Wildlife) conduct a joint review of the Burial Ground.[33]

The AEC Division of Operational Safety reviewed the NRTS Burial Ground in October 1969.[34] The AEC also established a General Manager's Task Force on AEC Operational Radioactive Waste Management to develop long-range policies, standards, and criteria for management of AEC waste.[35] This task force also examined sorting, compaction, and incineration of TRU waste.[36] The following were the general conclusions of the numerous surveys:[32, 33, 34, 35, 36, 37]

a. The burial of radioactive waste had not resulted in a health or safety problem in offsite areas.

b. The burial of long-lived radioactive waste, specifically plutonium, over the Snake River Plain aquifer was inadvisable, and provisions for segregating and removing such waste should be made, if such removal would not create a greater hazard than leaving the waste in place.

c. A minimum 0.6-m underburden in trenches and pits should be established.

d. The environmental monitoring program near the Burial Ground was not adequate to determine whether or not migration of radioactive material had taken place; deep observation wells should be drilled to monitor effects on water quality.

e. Flood control measures were not adequate.

f. Trenches and pits should be covered with at least 0.9 m of soil.

g. The volume of TRU waste could be substantially reduced through compaction.

4.1.2 Cessation of TRU Waste Burial

During 1969, the burial of TRU waste was reevaluated. In December 1969, J. R. Horan, ID-Health Services, recommended the suspension of burying intermediate-level waste from the Rocky Flats Plant during the winter or until the environmental hazard could be evaluated. He also noted there was evidence from experiences at other facilities that segregation of plutonium-contaminated waste was advisable.[38] A January 1970, letter from W. L. Ginkel, Manager of AEC-ID, to the manager of the Rocky Flats Plant stated that Rocky Flats waste would not be buried at the NRTS Burial Ground during the winter and spring because waste-handling techniques were being reevaluated and because of potential flooding.[39] After January 16, 1970, the waste was stacked aboveground.

4.1.3 Investigation of Alternative Sites

In 1969, AEC-ID began investigation of alternative burial sites at the NRTS. At the request of the AEC, the USGS investigated 17 NRTS sites as potential burial grounds.[35,40] In November 1969, a preliminary report recommended nine sites on the NRTS for further investigation.[40,41,42] Expansion of Burial Ground boundaries was also studied. In 1971, a report of an archaeological survey of the area surrounding the Burial Ground recommended that the area west and north of the existing Burial Ground not be disturbed in any expansion because of potential archaeological sites.[43] Minimal action has been taken beyond these studies in establishing additional sites or expanding the Burial Ground.

4.2 Changes in Disposal Procedures and Facilities

Several changes in disposal practices and facilities were initiated between 1964 and 1970. These changes included the following:

a. Increasing the minimum soil cover of buried radioactive waste from 0.6 to 0.9 m--1966[4]

b. Increasing the minimum trench depth from 0.9 to 1.5 m--1966[3]

c. Dropping a heavy steel plate on the waste dumped into trenches to compact it--1966[20,44]

d. Depositing at least 0.6 m of soil underburden in trenches and pits--1970 (this was done mainly in response of the Federal Water Pollution Control Administration Study).[32]

4.2.1 1966 Fires

Covering of waste in trenches at the end of each working week was enforced after two fires occurred at the Burial ground on September 8 and 9, 1966. The fires originated in Trench 42 where waste has been deposited in 0.6 by 0.6 by 0.9-m cardboard boxes. Trench 42 had been excavated on May 9, 1966, and waste was emplaced in July. One letter indicated that a wait for compaction may have delayed the backfilling of the trench. (Backfilling was a requirement of the AEC-ID Manual Chapter 0500-7, B-2-d of June 20, 1966.) Also, the amount of waste had increased significantly (34%) during August, and most heavy equipment operators were working at other facilities during the last half of the month.[44]

An apparent cause of the fires was the inadvertent inclusion of alkali metals with the low-radiation-level waste.[45] The AEC-ID Fire Department responded to a two-way radio alarm and extinguished the fires with water and bulldozing soil over the burning debris. Neither property damage nor detectable spread of contamination occurred.[14]

In October 1966, it was proposed that all waste dumped during the week be compacted and at least thinly covered with earth on Friday afternoon.[9,44] Sections considered completely filled were to be covered with 3 ft of soil. This backfilling of exposed material in trenches and pits on the last working day of the week became a standard procedure, and a firefighting plan also evolved.[4,8]

4.2.2 1969 Flooding

During a two-day January thaw in 1969, rainfall plus melting snow again inundated the Burial Ground. In addition to localized water, runoff from outside the Burial Ground flowed into it. Water filled Pit 10, considerable amounts entered Trenches 48 and 49, and some possibly entered Pit 9, which was partly open.[3] The 1969 flooding, shown in Figure 9, was partially caused by large snowdrifts that blocked the existing drainage, which had been established as a result of the 1962 flood. The runoff topped the old dikes and flowed through the Burial Ground.

After this flood, dikes around the Burial Ground were raised, and exterior drainage ditches were enlarged. New dikes and ditches were designed to withstand a major local runoff, even in the presence of deep snowdrifts. The ditches were made large enough so that, if necessary, heavy equipment could be used to clear snowdrifts.[14]

4.3 Environmental Monitoring

4.3.1 Monitoring at the Perimeter

In 1966, the 35 film badges used to monitor radiation at the perimeter of the Burial Ground were replaced by thermoluminescent dosimeters.[7] In November 1968, the number of TLD monitoring stations was reduced to 18.

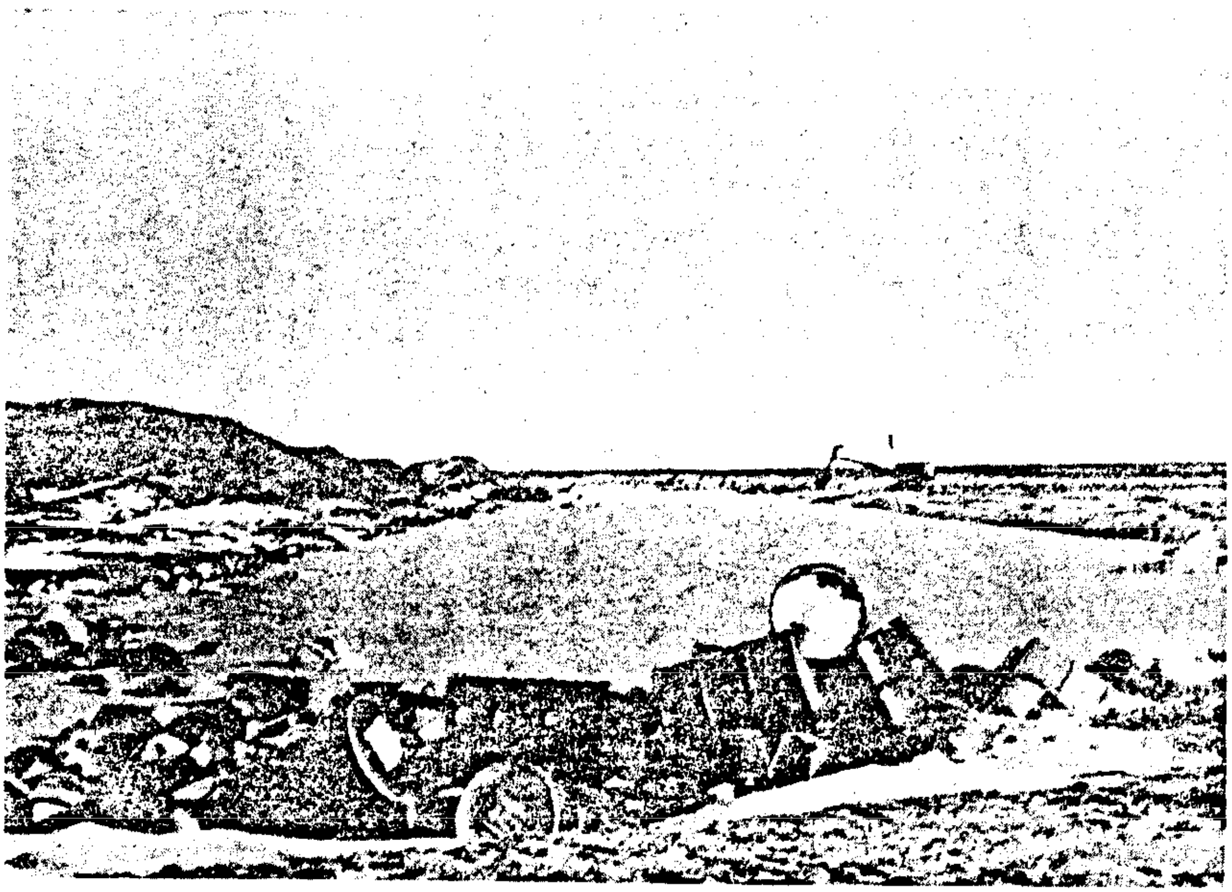


Figure 9. 1969 "Chinook"-caused flood at Burial Ground.

4.3.2 Subsurface Water Monitoring

In 1969, the USGS began a series of studies to detail the geology, hydrology, and available moisture and to determine the potential for migration of radionuclides from the buried waste.

Water samples taken from the subsurface monitoring holes after the spring thaw indicated the presence of cesium-137. Samples taken from new holes within 0.3 m of those holes failed to explain or confirm the presence of the cesium detected in the original monitoring holes.[30]

Two field investigations conducted by the Health Services Laboratory (HSL) in 1969 and 1970 showed that very limited leaching of radionuclides from the waste and migration of some fission products as well as plutonium isotopes and daughter products had occurred. An HSL report inferred that these conditions resulted from inundation of the waste as a result of poor drainage of snow-melt runoff. The concentrations and distances involved were insignificant and were not considered cause for concern for the aquifer.[30]

5. WASTE MANAGEMENT (1970-85)

On March 20, 1970, the AEC issued Immediate Action Directive (IAD) No. 0511-21, "Policy Statement Regarding Solid Waste Burial." This policy required segregation of all waste contaminated with long-lived transuranic nuclides in a concentration greater than 10 nCi/g of waste, and storage of that waste to permit retrieval of contamination-free waste containers after periods of up to 20 years.[14,46,47] In addition, the AEC made public, through letters to the State of Idaho, its commitment to remove the buried and stored TRU waste from the NRTS.[33]

5.1 Segregation of TRU Waste

During the first half of 1970, several methods were considered for the NRTS response to the new AEC directive on segregating TRU waste. These included (a) expansion and modification of the existing disposal operation, (b) above- or below-grade storage, and (c) storage at another site in natural or engineered facilities.[14] Above-grade storage was chosen, and the Burial Ground was expanded to its present 57.4 ha.[48]

DOE Order 5820.1, "Management of Transuranic Contaminated Material," dated September 30, 1982, changed the definition of TRU-contaminated material to read:

> Without regard to source or form, materials that at the end of institutional periods are contaminated with alpha-emitting radionuclides of atomic number greater than 92 and half-lives greater than 20 years in concentrations greater than 100 nCi/g

5.1.1 Temporary Aboveground Storage

While the decision to store TRU waste aboveground was being made, incoming Rocky Flats waste remained in a temporary aboveground storage established in January of 1970. On June 1, 1970, ID security personnel discovered a fire in the temporary aboveground storage. The fire was started by hot sunlight shining on a black drum containing depleted uranium turnings. The Fire Department responded immediately, but attempts failed to extinguish the fire in the waste stack. An equipment operator, using a crane, lifted and isolated the burning drum from the stack. A bulldozer then covered the drum with soil, extinguishing the fire. The air and direct radiation were monitored constantly, and the contamination spread was very low. Efforts were initiated to protect the other drums from any possible ignition by cooling them with a fine water spray. The upper surfaces were later coated with white paint to reduce the absorption of heat from the sun. Immediately after this fire, all drums were moved from temporary aboveground storage to a location where they could be covered with soil.[14]

5.1.2 Transuranic Storage Area (TSA) Pad 1

Construction of the Transuranic Storage Area (then known as the Idaho Transuranic Storage Area (ITSA)) was completed in October 1970.[7] The first Transuranic Storage Area (TSA) pad was 45.7 m wide by 121.9 m long and was surfaced with 10.2 cm of blacktop paving. (The length of the pad was extended to 222.5 m in 1972.) The paving was graded toward the centerline of the pad and sloped toward the north end to provide drainage.

The first waste was stored on TSA-1 November 9, 1970.[4] The pad was divided into 45.7 by 54.9-m cells with a 0.9-m-thick earth firewall isolating each cell.[14] In 1971, waste drums were stacked horizontally, nine drums high at the centerline of the pad and to a lesser height at the ends of each row, with crates lining the sides and down the center of the ITSA pad.[49] Begining December 22, 1972, in Cell 5, the drums were sacked vertically.[50] Containers were stacked 4.6 m high except within 9.14 m of the edge where the stack was limited to 3.7 m. A sheet of 1.3-cm-thick fire-retardant plywood was placed between every layer of drums to stabilize the stacking surface and increase overall rigidity.[14,50,51] The paved area was surrounded on three sides by a 3.7-m-high soil berm. A 1971 reference states that as the TSA pad was filled, the stacked waste was covered with a minimum of 0.5 m of earth from the surrounding berm.[49] However, a later report states that the final cover consisted of 1.6-cm-thick plywood, a tough nylon-reinforced polyvinyl cover, and 0.6 to 0.9 m of soil, placed over the containers in that order. The soil was then seeded to a sod building grass.[14] Figure 10 shows the cell arrangements and overview of the TSA pads, and Figure 11 shows an overview of the TDA.

Several changes were made in the TSA and in storage methods before TSA-1 was closed to receipt of waste on October 17, 1975. (Table 4 gives opening and closing dates of pad storage.) These changes described in the NRTS monthly reports and other documents are outlined below.

a. Buildings--The first buildings (a Burial Ground trailer and a TSA clothing-change trailer) were installed at the Burial Ground site in 1971.

b. Operations--

   1. In 1971, a hydraulic-cylinder unloader on the forklift pallet eased handling and cut labor costs and personnel injury hazards.[4]

   2. In 1972, large earth-moving equipment was used to cover TRU waste.

   3. By October of 1973, unloading and stacking of waste containers was accomplished in one mechanical operation with a telescoping-mast forklift. A mobile yard ramp, also obtained in 1973, was used for unloading palleted waste containers from trucks by forklift.[51]

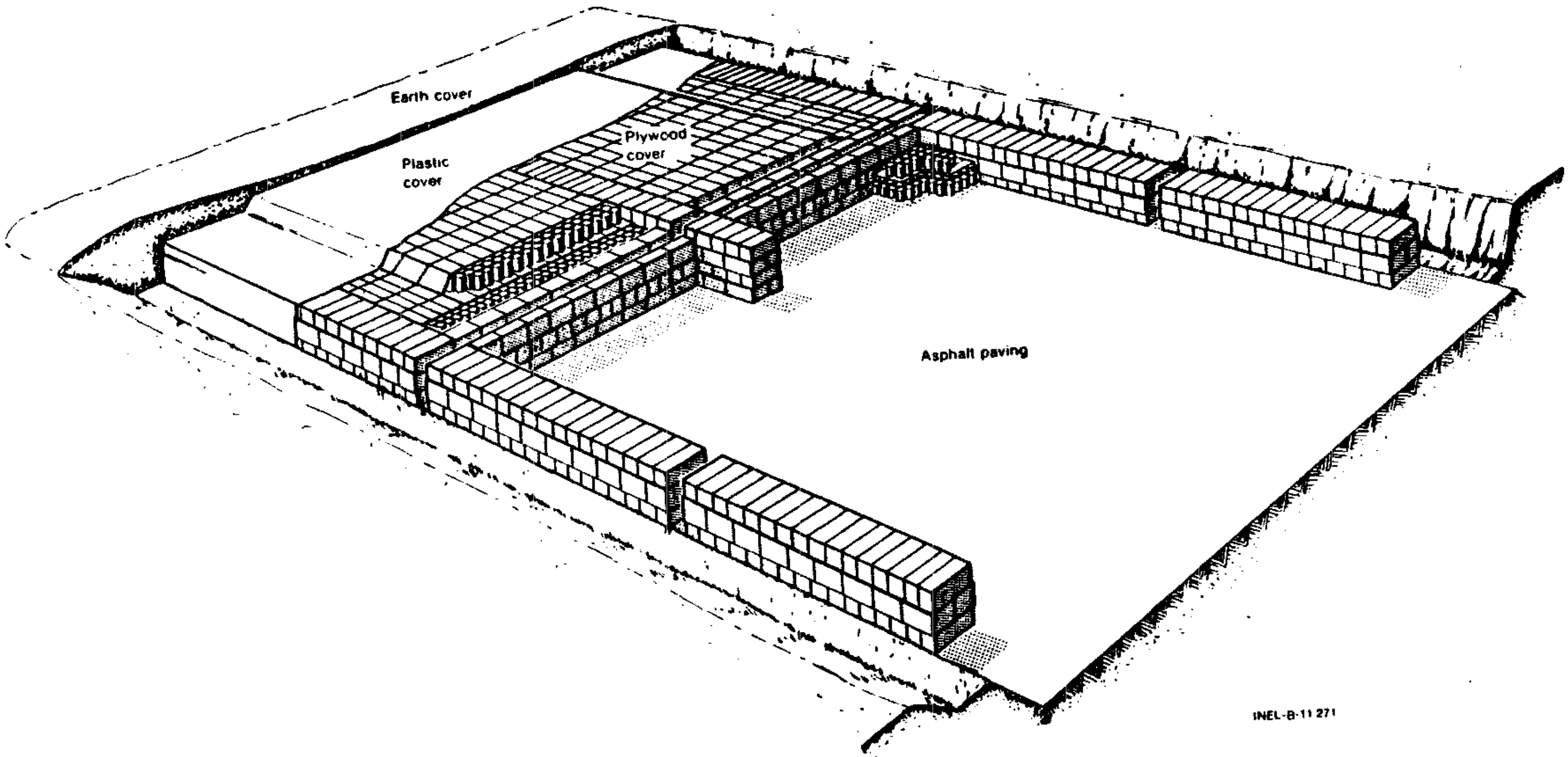


Figure 10. Transuranic Storage Area overview.

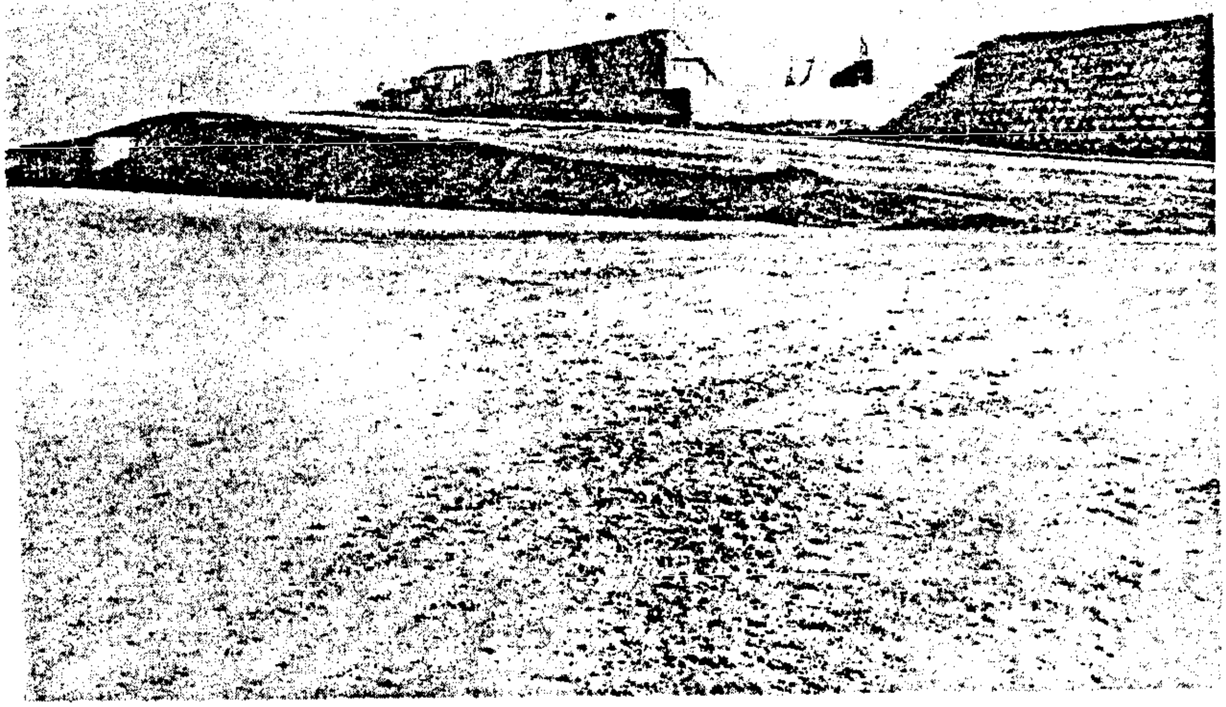


Figure 11. TDA pad before it was covered with soil.